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Evaluation of the Noise Assessment and Prediction System Used at Aberdeen Proving Ground

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13. ABSTRACT *(Maximum 200 words)*

The Noise Assessment and Prediction System at Aberdeen Proving Ground, MD predicts noise intensities generated in surrounding communities by an ordnance test given a vertical profile of wind, temperature, and humidity. When the predicted sound levels are too high, the test is postponed until atmospheric conditions are more favorable to minimize the number of complaints. To determine the accuracy of the predictions, the users matched several hundred microphone measurements collected at 15 sites between 24 January and 31 March 1994 within the Aberdeen area to ordnance blasts and statistically compared the measurements with sound intensities predicted for the same locations. The results presented in this report show how well the measured noise intensities were predicted as a function of time of day, microphone location, and time difference between the atmospheric and microphone measurements.

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Executive Summary

The Noise Assessment and Prediction System (NAPS) at Aberdeen Proving Ground, MD uses a ray-trace acoustic model to predict noise intensities that an ordnance test would generate in surrounding communities given the current atmospheric conditions. If the predicted sound levels are too high, testing is delayed until conditions are more favorable. Required NAPS input data consist of a vertical profile of wind, temperature, and humidity from the surface to at least 3 km, and the weapon type and charge weight used in the blast. The meteorological profiles are created by merging radiosonde, sodar, and tower measurements collected at the facility.

To determine the accuracy of the predictions, we matched 834 microphone measurements collected at 15 monitoring sites near the post between 24 January and 31 March 1994 with the ordnance blasts that caused them. The system was then used to predict the noise intensity at each microphone location for comparison with the measured data using meteorological profiles nearest in time to the blasts. Twenty-six of the 44 meteorological profiles used in the analyses represented times close to 0800 EST, and the remainder represented times between 1030 and 1330 EST.

The measured sound intensities were often significantly higher than the predicted intensities, especially in the early daylight hours. The mean underprediction was 9.2 dB for predictions using the 0800 EST meteorological profiles and 3.6 dB for predictions using the later profiles. Using only ordnance trials near in time to the meteorological data did not markedly improve the statistics.

To determine how often the system failed to predict high sound intensities, we counted the number of times that a microphone measurement was above 115 dB while the prediction was 110 dB or less. Using this criterion, approximately one-third of the 97 high noise measurements were not predicted. The number of false high noise intensity predictions was considerably lower. In approximately one-sixth of the predictions over 115 dB, the microphone measurement was less than 110 dB.

The tendency of the system to underestimate noise generated in surrounding communities by the earlier trials should be kept in mind when deciding if a test should be delayed. The lack of agreement between the measured and predicted data may be caused by (1) variations in the atmospheric structure between the time of the measurements and the time of the prediction, (2) differences in atmospheric structure along the acoustic path between the blast site and the microphone station, or (3) deficiencies in the ray-trace model.

1. Introduction

Aberdeen Proving Ground (APG), MD is located on the north shore of the Chesapeake Bay approximately 45 km northeast of Baltimore, MD. APG is surrounded by populated areas that are sometimes adversely affected by loud noises generated by military testing. The sound intensities encountered in these communities vary with atmospheric conditions. The Noise Assessment and Prediction System (NAPS) uses a ray-trace acoustic model to predict the sound intensities in the surrounding areas for a given test using upper-air and surface data collected on the post to minimize the noise problem. When the predicted noise levels are too high, testing is postponed until atmospheric conditions are more favorable.

To evaluate the NAPS, we compared predicted noise intensities for ordnance tests conducted between 24 January and 31 March 1994 with microphone measurements collected at 15 sites surrounding the post. We computed statistics of the differences between the predicted and measured sound intensities to determine the accuracy of the predictions as a function of time of day, microphone location, and time difference between the atmospheric measurement and the blast time. We also calculated statistics to show how often high-sound intensities at the sites were successfully predicted and how frequently high intensities were predicted and did not occur.

2. Description of NAPS

The current NAPS version used at APG and tested in this report is version 4.6, which was released in October 1991. Peak-noise intensities are estimated along radial paths up to 40 km from the blast source at or near the ground using a ray-trace acoustic propagation model. The peak-noise intensity information is written to a file that is used to draw a contour map of the noise intensities superimposed on a map of the APG area. Range personnel examine the plot to decide whether testing should proceed. NAPS runs on a personal computer using the disk operating system. Less than 1 min is required for most runs on a 486 DX computer. The ray-trace model assumes that each ray will be completely absorbed when it hits the ground and totally reflected off the water. A detailed mathematical description of the model is given in the *Technical Reference Guide for the Assessment and Prediction System (NAPS)* (Dietenberger, Luers, and Smith 1991).

Required NAPS input data consist of a vertical profile of wind, temperature, and humidity from the surface to at least 3 km; and the charge weight, the height of the charge above the surface, and weapon type. The terrain elevation and water locations along spokes surrounding each blast site are also needed. A complete description of the run options and the input and output formats is found in the *User's Reference Guide for Noise Assessment and Prediction System (NAPS)* (Smith, Luers, and Dietenberger 1992).

The input meteorological profile is created by merging measurements on a small mast with a radiosonde flight released at APG. When available, wind measurements from a Doppler sodar are added to provide additional data close to the surface. The sodars collect averaged wind data every 50 m, from 50 to about 400 m above the surface. A radiosonde flight is generally released every day at approximately 0800 EST. For late morning or afternoon tests, another sonde is sometimes flown later in the day to provide more current upper-air data. Alternately, a late morning or afternoon vertical profile is subjectively forecasted from an early morning profile by range meteorologists.

3. Analyses Description and Results

Microphone measurements were collected at 15 monitoring sites near APG between 24 January and 31 March 1994 during military testing. After the measurements were matched to the ordnance tests thought to have caused them, NAPS was used to estimate the noise intensities at the microphone locations using meteorological profiles closest in time to the detonations. The NAPS predictions were then statistically compared with the noise measurements to evaluate their accuracy. The tests were conducted at either Ballistic Range, Fuse Range, or Barricade A, B, or C. A map of the area displaying the locations of the microphones and blast sites is shown in figure 1 (the Barricade sites are within 1 km of Ballistic Range). The distances between these monitoring stations and Ballistic Range are given in table 1. Distances to the other denotation sites are similar.

All of the ordnance blasts were assumed to be spatially uniform. The charge weights were between 1 and 22 equivalent lb of C-4, and the charge height was 2 m.

Twenty-six of the meteorological profiles used in the study represented the atmosphere between 0730 and 0800 EST. The remaining 18 profiles represented atmospheric conditions between 1030 and 1330 EST, 6 of which were subjectively forecasted from an earlier profile and 12 of which were formed using radiosonde flights released later in the day.

For each ordnance test, sound intensities were predicted by NAPS along radial paths from the blast sites for every 5° of azimuth. This information was then interpolated to the microphone locations.

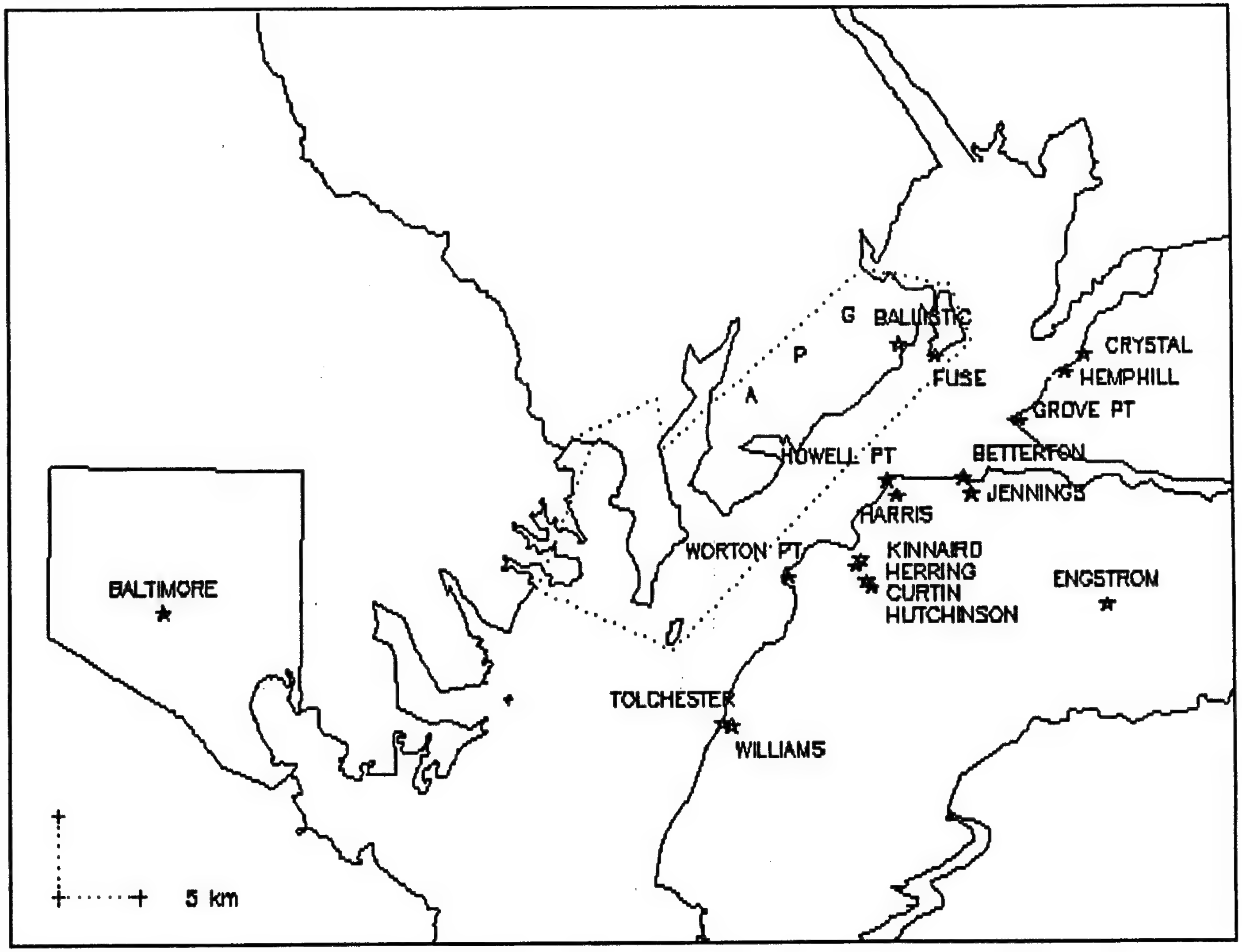

Figure 1. Map of area surrounding APG showing the detonation and microphone sites.

Table 1. Distances between Ballistic Range and microphones

Station	Distance (km)
Grove Point	8.4
Hemphill	10.2
Crystal Beach	12.2
Betterton	9.1
Jennings	10.2
Howell Point	8.3
Harris	9.3
Kinnaird Point	13.4
Herring	13.9
Curtin	14.7
Hutchinson	15.0
Worton Point	15.7
Engstrom	20.3
Tolchester	27.4
Williams	26.5

A total of 834 microphone measurements were matched with NAPS predictions. Because only one or two meteorological profiles per day were generated, there was often more than one trial matched to one prediction. When this occurred, all of the measurements associated with a given prediction were averaged. The resulting data base with 293 matched measured and predicted data points is listed in the appendix. In this study, only the microphone measurements greater than 100 dB were used to minimize the possibility that the measured noise was not generated by an APG trial, reducing the number of matched pairs to 266.

Histograms showing the frequency distribution of the 266 microphone measurements and NAPS predictions are plotted in figure 2. Most of the measurements were between 105 and 120 dB. The large number of predictions below 105 dB indicates that NAPS often underpredicted the noise intensities. There were also some predicted high sound intensities that did not occur. This is shown by the fact that there were 17 predictions greater than 125 dB but only one measurement that high.

The frequency distribution of the differences between the measured and predicted data is plotted in figure 3. The top portion shows the statistics using all 266 matches, and the bottom portion shows the results using the 246 matches in which the time difference between the atmospheric data and the microphone data was 2.5 h or less. The time differences in the larger data set ranged from 2 min to 7 h. Results for the two analyses are almost the same. Approximately 38 percent of the predicted noise intensities in the larger data base were within 5 dB of the microphone measurements, 58 percent of the predictions were more than 5 dB lower than the measured data, and 13 percent were more than 5 dB higher. The mean underprediction was 4.8 dB.

The same analyses for predictions from the early morning (0730 to 0800 EST) radiosondes are plotted in figure 4. The top portion of the figure contains statistics for all the early trials, and the bottom portion shows results for the 5-lb demonstration trials. The latter were earlier in the morning and closer in time to the meteorological data than were the other morning trials. Most of the 5-lb rounds were exploded within 30 min of the atmospheric data. This did not result in better agreement between the measured and predicted data, however. The median underprediction was 10.5 dB for the 5-lb trials and 9.2 dB for all early trials.

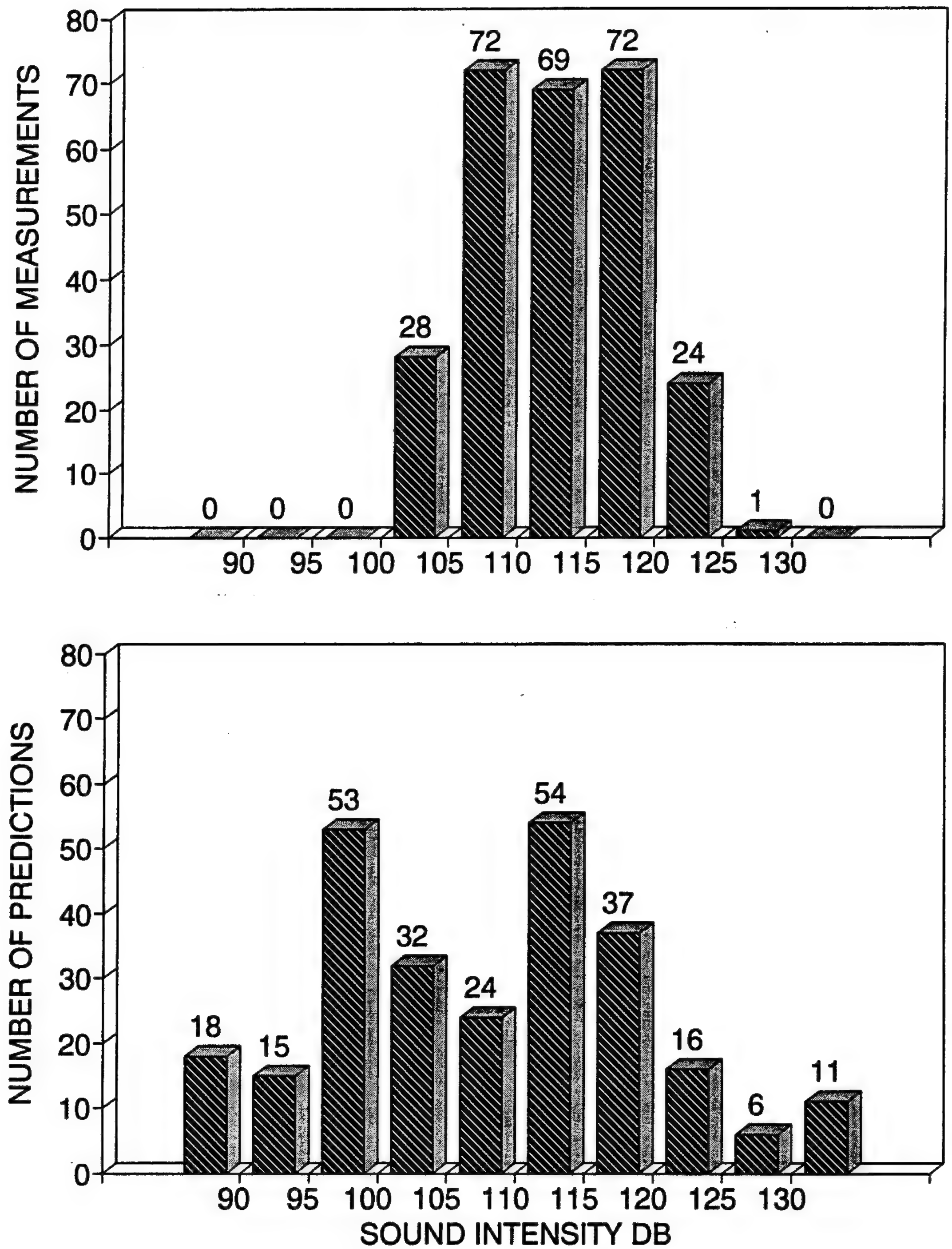

Figure 2. Frequency distribution of sound intensity measured by microphones (top) and predicted by NAPS (bottom).

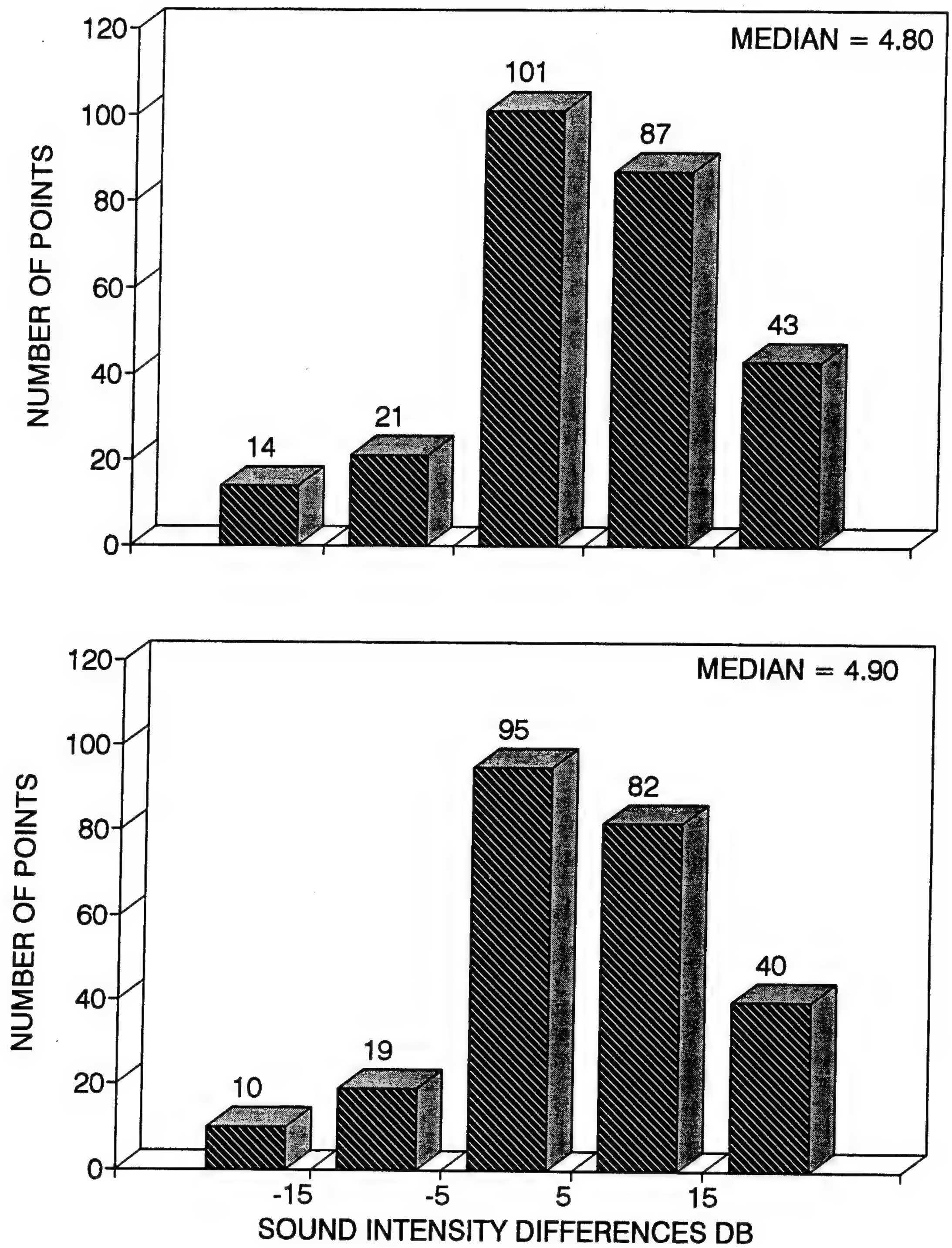

Figure 3. Frequency distribution of differences in sound intensity between NAPS predictions and microphone measurements using all matched data (top) and matched data within 2.5 h of each other (bottom).

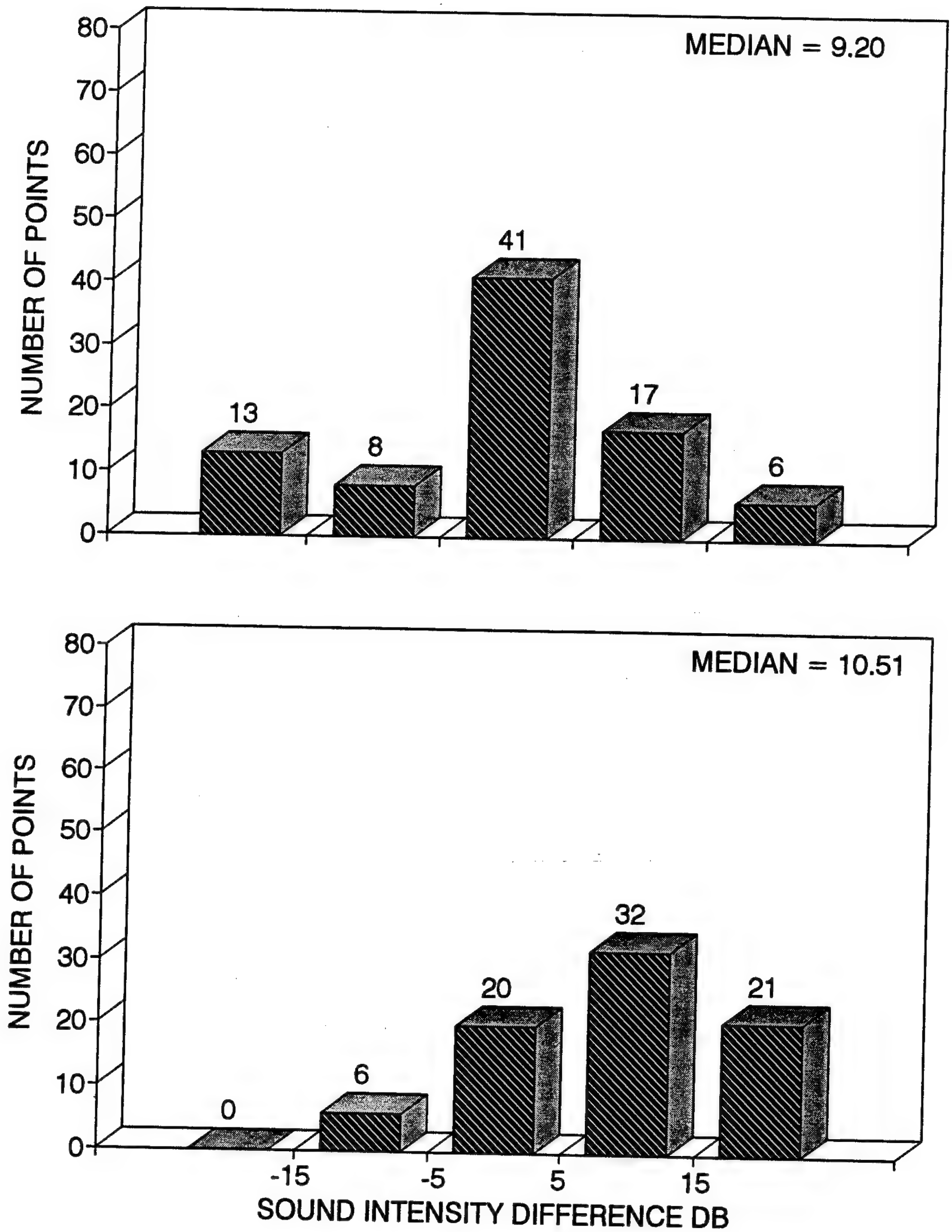

Figure 4. NAPS and microphone measurement predicted frequency distribution of sound intensity differences for trials matched with early meteorological data (top) and the 5-lb trials (bottom).

The predictions using the late morning or early afternoon atmospheric profiles (1030 to 1330 EST) shown in figure 5 were much closer to the actual measurements. The top histogram shows statistics using all 18 late profiles, while the bottom represents statistics for only the 12 that were not forecasted from earlier flights. The mean underpredictions were 3.6 and 3.7 dB, respectively.

To investigate how the degree of agreement between the measured and predicted data varied among different areas surrounding APG, we performed the above analyses separately for three groups of microphone stations. Crystal Beach, Grove Point, and Hemphill comprised one group; Harris, Howell Point, Betterton, and Jennings comprised another; and Worton Point, Kinnaird, Herring, Curtin, and Hutchinson comprised the third group. The microphones within each group were close to each other and about the same direction and distance from the blast sites. The results are shown in figure 6. Underpredictions of 1.5 dB for the first group, 5.8 dB for the second group, and 9.1 dB for the third group were found. Separate statistics using the early morning and the late morning/early afternoon meteorological profiles are shown in figures 7 and 8, respectively. Again, the biases between the measured and predicted data were lowest for the first group of stations and highest for the third group. The comparability of the NAPS predictions was considerably better later in the day for all three groups of stations.

To specifically demonstrate how often NAPS failed to predict high sound intensities that occurred in the areas surrounding APG, we counted the number of microphone measurements above 115 dB for which the NAPS estimate was less than 110 dB. Using this criterion, 34 of the 97 high-noise events, or approximately one-third, were not predicted.

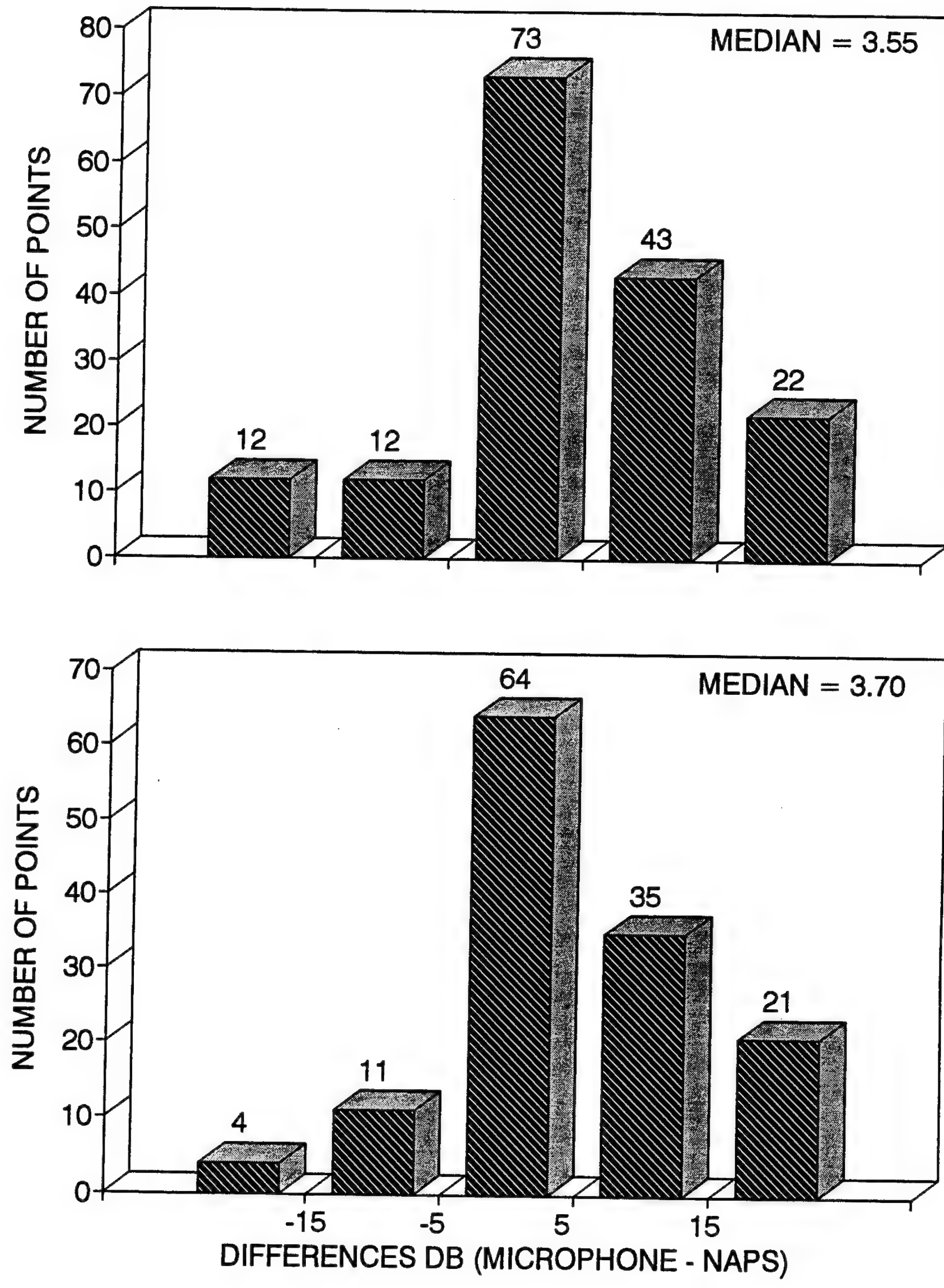

Figure 5. NAPS and microphone measurement predicted frequency distribution of sound intensity differences using trials matched with late meteorological data (top) and excluding forecasted meteorological data (bottom).

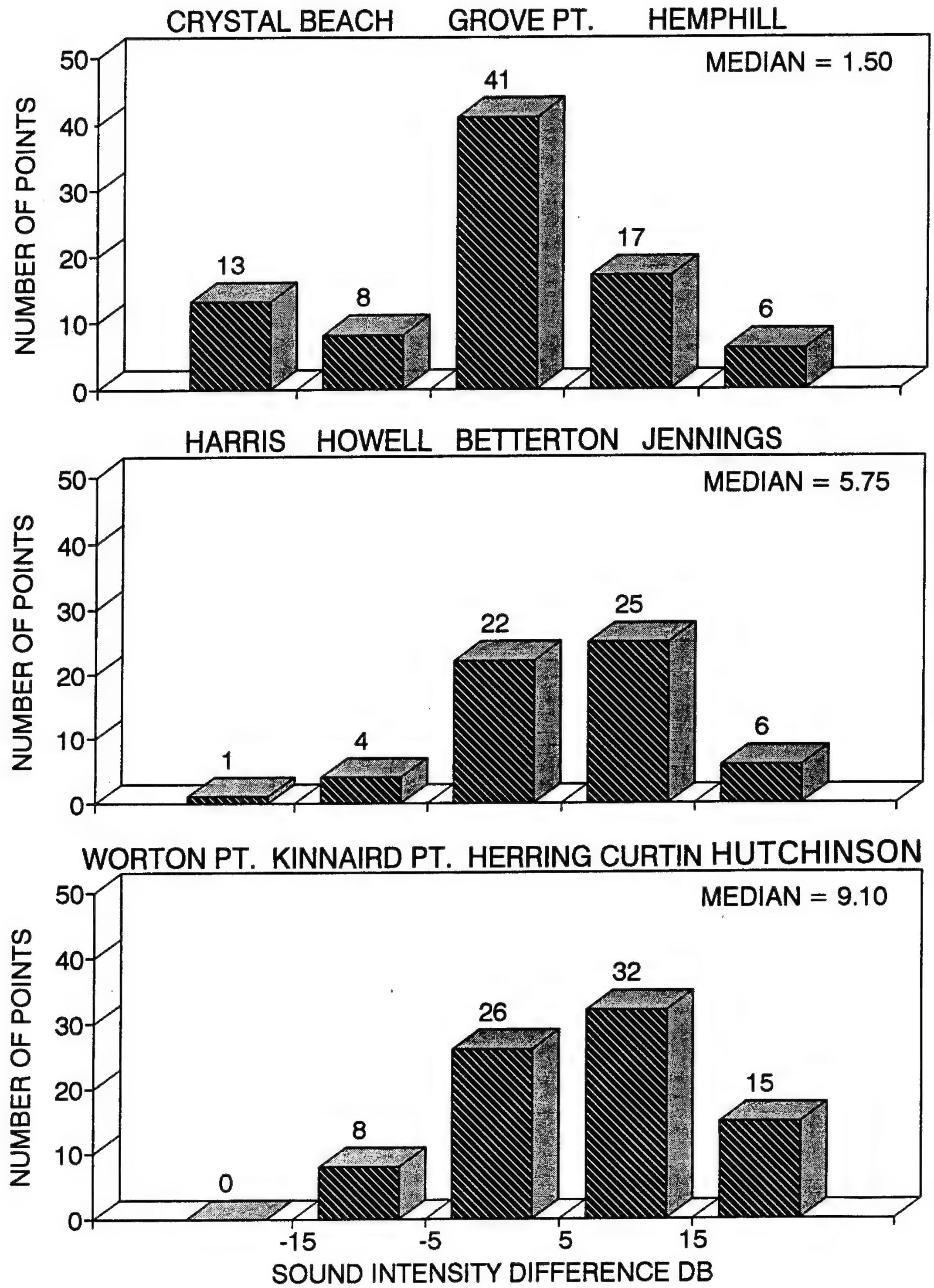

Figure 6. Frequency distribution of differences between NAPS sound intensity predictions and microphone measurements for three groups of stations.

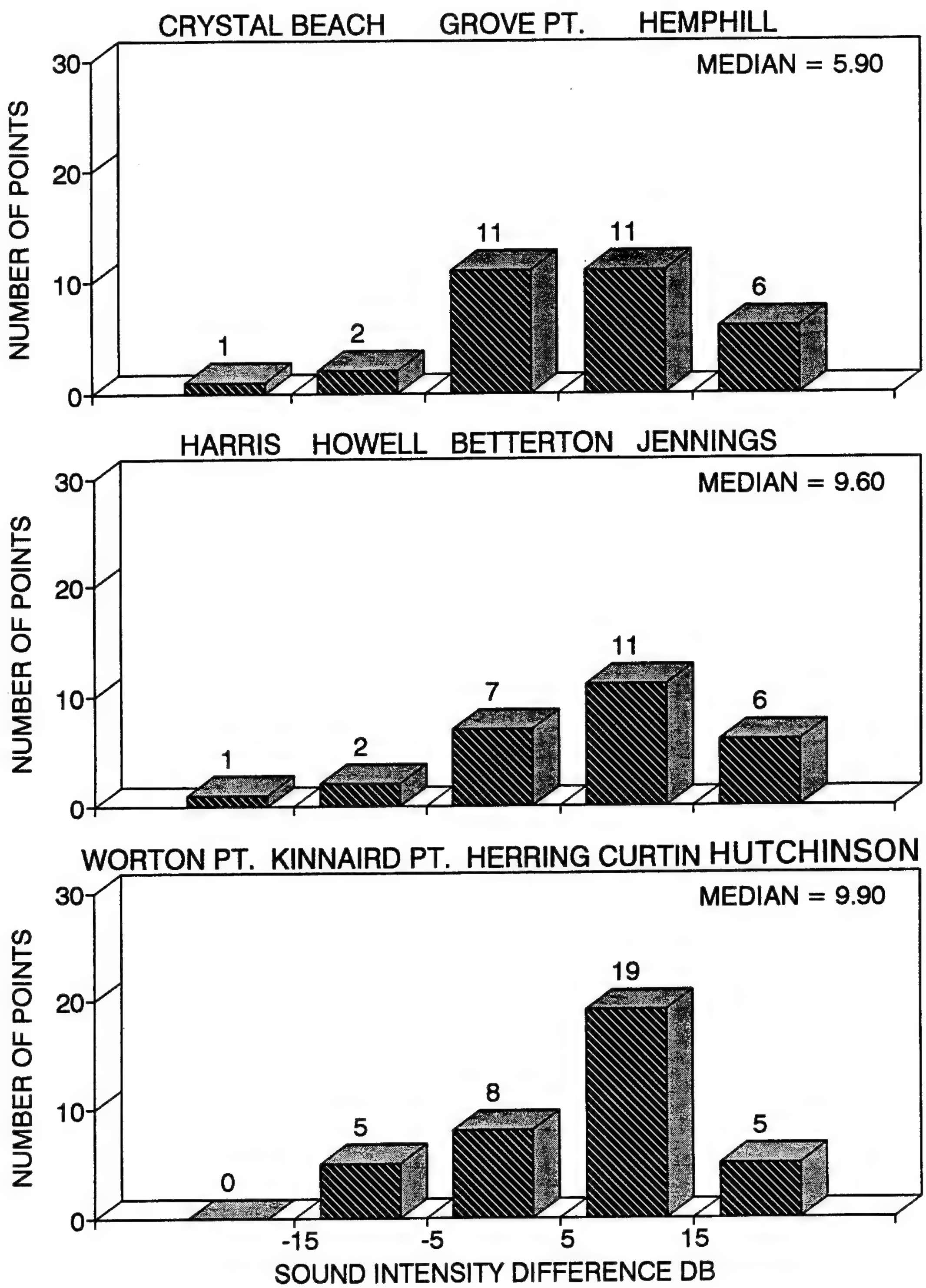

Figure 7. Frequency distribution of differences between NAPS sound intensity predictions and microphone measurements using trials matched with early meteorological data for three groups of stations.

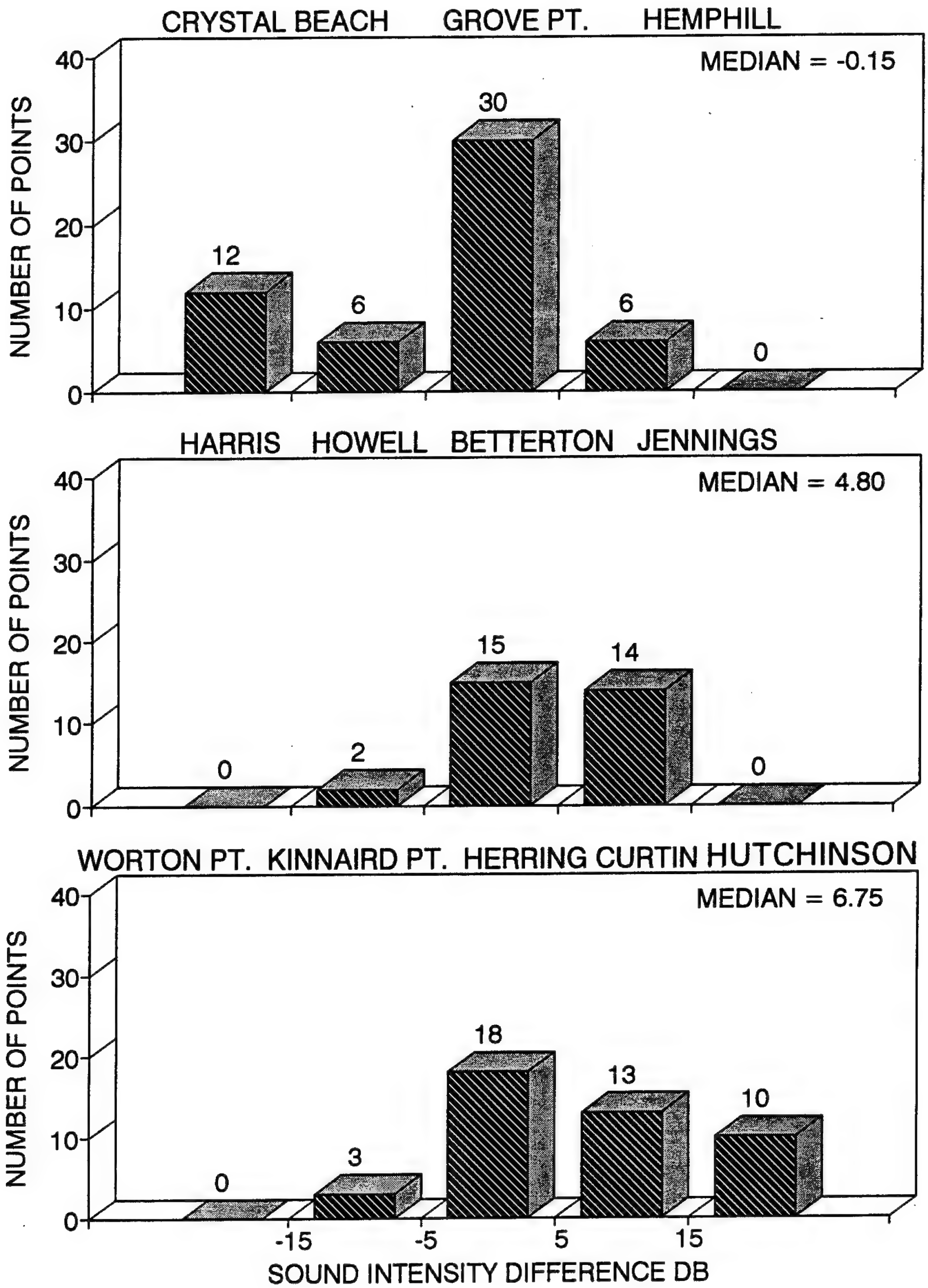

Figure 8. Frequency distribution of differences between NAPS sound intensity predictions and microphone measurements using trials matched with late meteorological data for three groups of stations.

Similar analyses were conducted using NAPS predictions for three groups of stations that define different regions surrounding APG. Crystal Beach, Hemphill, and Grove Point comprised the first group; Howell Point, Harris, Betterton, and Jennings formed the second group; and Kinnaird, Herring, Curtin, and Hutchinson comprised the third group. Anytime one or more microphone measurements within a group were greater than 115 dB, the event was considered to be high-noise. If a NAPS prediction for any station in that group was greater than 110 dB during one of these events, the prediction was considered successful. Using this criterion, 29 of 46 high-noise events were successfully predicted and 17, or a little more than one-third, were not. An early balloon flight was used in all but 1 of the 17 failed predictions.

The number of times that high-noise events were predicted but were not measured was considerably smaller. Only 12 of the 70 NAPS predictions above 115 dB were matched with a measurement below 110 dB.

4. Summary and Recommendations

Although the use of NAPS would undoubtedly reduce the number of noise complaints, there was a tendency for the ray-trace model to underestimate the sound intensities on the other side of the Chesapeake Bay, especially during the first few hours after sunrise. This characteristic should be kept in mind when deciding if a test should be postponed.

Some of the differences between the measurements and the predictions may have been caused by spatial variations in the atmosphere along the acoustic paths. Most of the sound travel was over the Chesapeake Bay. Atmospheric profiles at APG, where the meteorological measurements were collected, could have been significantly different from the profiles over the bay. Temporal differences in atmospheric structure between the times the meteorological measurements were collected and the test times may also have caused errors. The boundary layer often changes rapidly during the first hours after sunrise. In this study, however, agreement between the measured and predicted data did not improve when only microphone data near in time to the atmospheric measurements were compared. It is also possible that the sound propagation was simply not being modeled very well in the early daylight hours when there was downward refraction. In that case, the model may have to be modified or another one substituted.

References

Dietenberger, M. A., J. K. Luers, and J. A. Smith, *Technical Reference Guide for Noise Assessment and Prediction System (NAPS)*, UDR-TR-91-87, University of Dayton, Dayton, OH, September 1991.

Smith, J. A., J. K. Luers, and M. A. Dietenberger, *User's Reference Guide for Noise Assessment and Prediction System (NAPS)*, ASL-CR-92-0209-1, Battlefield Environment Directorate, Army Research Laboratory, White Sands Missile Range, NM, July 1992.

Appendix

Matched NAPS Predictions and Averaged Microphone Measurements Used in the Analyses

RANGE	RAOB TIME	STATION	DATE	FIRING TIME	TIME DIFF	MIC	NAPS	DIFF	CHARGE
BALLISTIC	800.00	HUTCHINSON	JAN 24	0902-0902	0102-0102	105.4	94.8	10.6	5.0
BALLISTIC	800.00	HARRIS	JAN 25	0826-0826	0026-0026	119.1	109.5	9.6	5.0
BALLISTIC	800.00	HOWELL PT	JAN 25	0826-0826	0026-0026	119.5	104.5	15.0	5.0
BALLISTIC	800.00	WORTON PT	JAN 25	0827-0827	0027-0027	112.0	91.8	20.2	5.0
BALLISTIC	1235.00	CRYSTAL B	JAN 25	1430-1443	0155-0208	109.9	106.4	3.5	22.2
BALLISTIC	1235.00	HARRIS	JAN 25	1053-1537	0103-0302	106.5	106.2	.4	22.2
BALLISTIC	1235.00	HOWELL PT	JAN 25	1053-1447	0115-0212	112.3	107.5	4.8	22.2
BALLISTIC	1235.00	WORTON PT	JAN 25	1050-1120	0115-0145	111.0	96.6	14.4	22.2
BALLISTIC	1235.00	HUTCHINSON	JAN 25	1050-1451	0055-0216	100.6	100.5	.1	22.2
BALLISTIC	800.00	HARRIS	JAN 26	0829-0829	0029-0029	118.9	98.2	20.7	5.0
BALLISTIC	800.00	HARRIS	JAN 26	0954-1457	0154-0657	113.3	102.8	10.6	21.0
BALLISTIC	800.00	WORTON PT	JAN 26	0954-1443	0154-0643	108.7	96.4	12.3	21.0
BALLISTIC	800.00	KINNAIRD	JAN 26	0829-0829	0029-0029	106.3	93.7	12.6	5.0
BALLISTIC	800.00	KINNAIRD	JAN 26	0954-1457	0154-0657	108.6	98.3	10.3	21.0
BALLISTIC	800.00	HUTCHINSON	JAN 26	0954-1457	0154-0657	106.2	97.2	9.0	21.0
BALLISTIC	800.00	CRYSTAL B	JAN 31	1441-1445	0641-0645	110.2	114.4	-4.2	22.0
BALLISTIC	800.00	GROVE PT	JAN 31	1353-1445	0553-0645	111.1	127.5	-16.4	22.0
BALLISTIC	800.00	JENNINGS	JAN 31	0816-0816	0016-0016	106.3	99.9	6.4	5.0
BALLISTIC	800.00	JENNINGS	JAN 31	1338-1442	0538-0642	103.9	104.6	-.7	22.0
BALLISTIC	800.00	WORTON PT	JAN 31	1415-1415	0615-0615	115.0	97.2	17.8	22.0
BALLISTIC	800.00	KINNAIRD	JAN 31	1359-1441	0559-0641	109.3	100.1	9.3	22.0
BALLISTIC	800.00	CURTIN	JAN 31	0815-0815	0015-0015	108.9	95.4	13.5	5.0
BALLISTIC	800.00	CURTIN	JAN 31	1338-1441	0538-0641	107.9	100.1	7.8	22.0
FUZE	1130.00	CRYSTAL B	FEB 01	1621-1621	0451-0451	108.5	109.4	-.9	4.0
FUZE	1130.00	JENNINGS	FEB 01	1016-1542	0038-0412	102.8	97.6	5.2	4.0
FUZE	1130.00	KINNAIRD	FEB 01	1026-1026	0104-0104	106.1	92.4	13.7	4.0
FUZE	1130.00	CURTIN	FEB 01	1509-1555	0339-0425	114.1	93.0	21.1	4.0
BALLISTIC	800.00	CRYSTAL B	FEB 02	0827-0827	0027-0027	113.3	109.8	3.5	5.0
BALLISTIC	800.00	JENNINGS	FEB 02	0827-0827	0027-0027	98.5	97.1	1.4	5.0
BALLISTIC	800.00	CURTIN	FEB 02	0826-0826	0026-0026	94.8	92.6	2.2	5.0
BALLISTIC	1100.00	CRYSTAL B	FEB 02	0940-0940	0120-0120	108.8	106.9	1.9	6.0
BALLISTIC	1100.00	JENNINGS	FEB 02	0939-0943	0117-0121	105.1	97.6	7.5	6.0
BALLISTIC	1100.00	JENNINGS	FEB 02	1054-1142	0000-0042	99.9	101.8	-1.9	22.0
BALLISTIC	1100.00	WORTON PT	FEB 02	1131-1137	0031-0037	108.8	96.5	12.3	22.0
BALLISTIC	1100.00	KINNAIRD	FEB 02	1102-1125	0002-0025	106.2	98.4	7.8	22.0
BALLISTIC	1100.00	CURTIN	FEB 02	1056-1142	0000-0042	109.5	97.3	12.2	22.0
BALLISTIC	1300.00	CRYSTAL B	FEB 02	1343-1414	0043-0114	109.3	114.1	-4.8	6.0
BALLISTIC	1300.00	JENNINGS	FEB 02	1325-1423	0025-0123	100.2	97.6	2.6	6.0

RANGE	RAOB TIME	STATION	DATE	FIRING TIME	TIME DIFF	MIC	NAPS	DIFF	CHARGE
BALLISTIC	1300.00	KINNAIRD	FEB 02	1323-1329	0023-0029	107.0	94.3	12.7	6.0
BALLISTIC	1300.00	CURTIN	FEB 02	1322-1342	0021-0042	100.0	93.2	6.8	6.0
BALLISTIC	1300.00	TOLCHESTER	FEB 02	1322-1322	0021-0021	110.4	85.6	24.8	6.0
FUZE	1300.00	JENNINGS	FEB 02	1522-1522	0222-0222	102.4	97.5	4.9	4.0
BALLISTIC	800.00	CRYSTAL B	FEB 03	0820-0820	0020-0020	116.7	102.5	14.2	5.0
BALLISTIC	800.00	CRYSTAL B	FEB 03	1007-1043	0207-0243	108.8	103.1	5.8	6.0
BALLISTIC	800.00	CRYSTAL B	FEB 03	1320-1342	0520-0542	108.6	107.2	1.4	22.0
BALLISTIC	800.00	GROVE PT	FEB 03	0820-0820	0020-0020	116.7	119.3	-2.6	5.0
BALLISTIC	800.00	GROVE PT	FEB 03	1001-1036	0201-0236	116.7	119.9	-3.2	6.0
BALLISTIC	800.00	GROVE PT	FEB 03	1318-1318	0518-0518	116.7	123.9	-7.2	22.0
BALLISTIC	800.00	JENNINGS	FEB 03	1037-1037	0237-0237	113.3	120.3	-7.0	6.0
BALLISTIC	800.00	JENNINGS	FEB 03	1318-1408	0518-0608	107.2	124.5	-17.3	22.0
BALLISTIC	800.00	WORTON PT	FEB 03	1323-1356	0523-0556	106.5	96.5	9.9	22.0
BALLISTIC	800.00	CURTIN	FEB 03	1014-1050	0214-0250	103.3	93.2	10.1	6.0
BALLISTIC	800.00	CURTIN	FEB 03	1318-1401	0518-0601	105.6	97.3	8.2	22.0
FUZE	1100.00	CRYSTAL B	FEB 04	0930-1049	0011-0130	109.2	125.1	-15.9	4.0
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FUZE	1100.00	TOLCHESTER	FEB 04	0960-1014	0046-0100	105.3	84.1	21.2	4.0
BALLISTIC	800.00	CRYSTAL B	FEB 07	0817-0817	0017-0017	114.3	99.2	15.1	5.0
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BALLISTIC	800.00	GROVE PT	FEB 07	0817-0817	0017-0017	121.0	110.5	10.5	5.0
BALLISTIC	800.00	GROVE PT	FEB 07	1017-1107	0217-0307	113.7	111.1	2.6	6.0
BALLISTIC	800.00	WORTON PT	FEB 07	0818-0818	0018-0018	107.5	106.3	1.2	5.0
BALLISTIC	800.00	WORTON PT	FEB 07	1001-1107	0201-0307	108.9	106.8	2.0	6.0
BALLISTIC	800.00	KINNAIRD	FEB 07	0819-0819	0019-0019	114.8	103.5	11.3	5.0
BALLISTIC	800.00	KINNAIRD	FEB 07	1036-1106	0236-0306	107.7	104.1	3.6	6.0
BALLISTIC	800.00	HERRING	FEB 07	0816-0816	0016-0016	117.0	104.1	12.9	5.0
BALLISTIC	800.00	HERRING	FEB 07	1002-1106	0202-0306	107.3	104.7	2.6	6.0
BALLISTIC	800.00	ENGSTROM	FEB 07	0816-0816	0016-0016	110.5	88.6	21.9	5.0
BALLISTIC	800.00	ENGSTROM	FEB 07	1001-1107	0201-0307	98.6	89.2	9.4	6.0
BALLISTIC	800.00	GROVE PT	FEB 08	0943-0943	0143-0143	107.4	119.6	-12.2	22.0
BALLISTIC	800.00	KINNAIRD	FEB 08	0957-1005	0157-0205	107.5	98.4	9.1	22.0
BALLISTIC	800.00	HERRING	FEB 08	0815-0815	0015-0015	97.6	93.3	4.3	5.0
BALLISTIC	800.00	HERRING	FEB 08	0943-1003	0143-0203	108.2	98.0	10.1	22.0
BALLISTIC	800.00	ENGSTROM	FEB 08	0943-1005	0143-0205	99.6	112.1	-12.5	22.0
BARRIC A	1030.00	GROVE PT	FEB 15	0850-1030	0000-0140	113.3	113.1	.1	13.0
BARRIC A	1030.00	GROVE PT	FEB 15	0851-1031	0001-0125	111.6	113.8	-2.2	16.3
BARRIC A	1030.00	GROVE PT	FEB 15	1033-1033	0003-0003	112.1	113.9	-1.8	16.7
BARRIC A	1030.00	HARRIS	FEB 15	0938-1030	0000-0052	94.1	101.1	-7.0	13.0
BARRIC A	1030.00	HARRIS	FEB 15	1031-1031	0001-0001	96.1	101.9	-5.8	16.3

RANGE	RAOB TIME	STATION	DATE	FIRING TIME	TIME DIFF	MIC	NAPS	DIFF	CHARGE
BARRIC A	1030.00	HUTCHINSON	FEB 15	1030-1030	0000-0000	93.6	97.2	-3.6	13.0
BARRIC A	1030.00	HUTCHINSON	FEB 15	0851-0905	0125-0139	86.5	97.9	-11.4	16.3
BARRIC A	1030.00	HUTCHINSON	FEB 15	0907-0907	0123-0123	85.5	97.9	-12.4	16.7
BARRIC A	1030.00	HUTCHINSON	FEB 15	1021-1021	0009-0009	94.9	98.2	-3.3	18.0
BARRIC A	1100.00	GROVE PT	FEB 15	1113-1151	0013-0051	116.8	109.0	7.8	13.0
BARRIC A	1100.00	GROVE PT	FEB 15	1115-1153	0015-0053	116.4	109.8	6.5	16.7
BARRIC A	1100.00	GROVE PT	FEB 15	1104-1142	0004-0042	114.0	110.1	3.9	18.0
BARRIC A	1100.00	HARRIS	FEB 15	1113-1151	0013-0051	107.6	101.1	6.5	13.0
BARRIC A	1100.00	HARRIS	FEB 15	1114-1153	0014-0053	107.7	101.9	5.8	16.3
BARRIC A	1100.00	HARRIS	FEB 15	1115-1115	0015-0015	105.6	101.9	3.7	16.7
BARRIC A	1100.00	HARRIS	FEB 15	1142-1142	0042-0042	114.6	102.2	12.4	18.0
BARRIC A	1100.00	HUTCHINSON	FEB 15	1113-1151	0013-0051	97.9	97.2	.7	13.0
BARRIC A	1100.00	HUTCHINSON	FEB 15	1114-1153	0014-0053	98.2	97.9	.3	16.3
BARRIC A	1100.00	WILLIAMS	FEB 15	1151-1151	0051-0051	100.1	88.7	11.4	13.0
BARRIC A	1100.00	WILLIAMS	FEB 15	1153-1153	0053-0053	99.0	89.5	9.5	16.7
BARRIC A	1100.00	WILLIAMS	FEB 15	1142-1142	0042-0042	103.5	89.7	13.8	18.0
BARRIC A	1330.00	GROVE PT	FEB 15	1228-1228	0102-0102	115.2	130.6	-15.4	13.0
BARRIC A	1330.00	GROVE PT	FEB 15	1229-1229	0101-0101	115.9	131.4	-15.5	16.3
BARRIC A	1330.00	GROVE PT	FEB 15	1231-1231	0059-0059	117.0	131.4	-14.4	16.7
BARRIC A	1330.00	GROVE PT	FEB 15	1220-1220	0110-0110	115.3	131.7	-16.4	18.0
BARRIC A	1330.00	WILLIAMS	FEB 15	1220-1220	0110-0110	105.4	89.7	15.7	18.0
BALLISTIC	800.00	GROVE PT	FEB 16	0827-0827	0027-0027	117.8	109.1	8.7	5.0
BALLISTIC	800.00	BETTERTON	FEB 16	0827-0827	0027-0027	114.8	122.7	-7.9	5.0
BALLISTIC	800.00	KINNAIRD	FEB 16	0827-0827	0027-0027	106.2	111.5	-5.3	5.0
BALLISTIC	800.00	HUTCHINSON	FEB 16	0827-0827	0027-0027	81.9	106.2	-24.3	5.0
BALLISTIC	800.00	WILLIAMS	FEB 16	0826-0826	0026-0026	99.1	104.1	-5.0	5.0
BALLISTIC	800.00	GROVE PT	FEB 18	0816-0816	0016-0016	116.9	115.3	1.6	5.0
BALLISTIC	800.00	HARRIS	FEB 18	0815-0815	0015-0015	120.6	121.5	-.9	5.0
BALLISTIC	800.00	HOWELL PT	FEB 18	0815-0815	0015-0015	121.9	106.1	15.8	5.0
BALLISTIC	800.00	BETTERTON	FEB 18	0816-0816	0016-0016	124.1	114.5	9.6	5.0
BALLISTIC	800.00	WORTON PT	FEB 18	0816-0816	0016-0016	112.0	114.7	-2.7	5.0
BALLISTIC	800.00	KINNAIRD	FEB 18	0816-0816	0016-0016	106.7	117.3	-10.6	5.0
BALLISTIC	800.00	WILLIAMS	FEB 18	0816-0816	0016-0016	104.6	98.1	6.5	5.0
BALLISTIC	800.00	TOLCHESTER	FEB 18	0816-0816	0016-0016	106.3	96.0	10.3	5.0
FUZE	1300.00	HARRIS	FEB 18	1421-1457	0121-0157	110.1	99.7	10.5	10.0
FUZE	1300.00	HOWELL PT	FEB 18	1421-1457	0121-0157	108.5	101.3	7.2	10.0
FUZE	1300.00	HUTCHINSON	FEB 18	1439-1451	0139-0151	100.1	95.7	4.3	10.0
BALLISTIC	800.00	HEMPHILL	FEB 22	0818-0818	0018-0018	115.3	108.9	6.4	5.0
BALLISTIC	800.00	GROVE PT	FEB 22	0819-0819	0019-0019	119.2	109.7	9.5	5.0
BALLISTIC	800.00	BETTERTON	FEB 22	0819-0819	0019-0019	120.7	108.8	11.9	5.0

RANGE	RAOB TIME	STATION	DATE	FIRING TIME	TIME DIFF	MIC	NAPS	DIFF	CHARGE
BALLISTIC	800.00	CURTIN	FEB 22	0818-0818	0018-0018	111.4	100.1	11.3	5.0
BALLISTIC	800.00	GROVE PT	FEB 24	0813-0813	0013-0013	113.1	102.8	10.3	5.0
BALLISTIC	800.00	JENNINGS	FEB 24	0813-0813	0013-0013	111.6	97.1	14.5	5.0
BALLISTIC	800.00	BETTERTON	FEB 24	0813-0813	0013-0013	123.5	98.5	25.0	5.0
BARRIC A	1230.00	CRYSTAL B	FEB 24	1025-1025	0205-0205	115.0	111.5	3.5	13.0
BARRIC A	1230.00	CRYSTAL B	FEB 24	1310-1310	0040-0040	112.1	112.5	-.4	16.7
BARRIC A	1230.00	CRYSTAL B	FEB 24	1335-1335	0105-0105	115.0	112.7	2.3	18.0
BARRIC A	1230.00	HEMPHILL	FEB 24	1025-1308	0038-0205	118.7	113.9	4.8	13.0
BARRIC A	1230.00	HEMPHILL	FEB 24	1026-1309	0039-0205	118.9	114.7	4.2	16.3
BARRIC A	1230.00	HEMPHILL	FEB 24	1027-1310	0040-0203	116.6	114.7	1.8	16.7
BARRIC A	1230.00	HEMPHILL	FEB 24	1018-1403	0033-0212	117.5	115.0	2.5	18.0
BARRIC A	1230.00	GROVE PT	FEB 24	1025-1308	0038-0205	114.9	114.5	.4	13.0
BARRIC A	1230.00	GROVE PT	FEB 24	1026-1134	0056-0208	116.7	115.3	1.4	16.3
BARRIC A	1230.00	GROVE PT	FEB 24	1027-1310	0040-0203	117.3	115.4	1.9	16.7
BARRIC A	1230.00	GROVE PT	FEB 24	1018-1303	0032-0212	117.1	115.7	1.5	18.0
BARRIC A	1230.00	JENNINGS	FEB 24	1025-1133	0057-0205	117.4	111.5	6.0	13.0
BARRIC A	1230.00	JENNINGS	FEB 24	1026-1134	0056-0205	120.8	112.4	8.5	16.3
BARRIC A	1230.00	JENNINGS	FEB 24	1027-1135	0055-0206	121.7	112.5	9.2	16.7
BARRIC A	1230.00	JENNINGS	FEB 24	1018-1408	0102-0212	117.0	112.8	4.2	18.0
BARRIC A	1230.00	WORTON PT	FEB 24	1025-1133	0057-0205	111.7	117.2	-5.5	13.0
BARRIC A	1230.00	WORTON PT	FEB 24	1026-1134	0056-0205	115.3	117.9	-2.6	16.3
BARRIC A	1230.00	WORTON PT	FEB 24	1027-1135	0055-0203	113.5	118.0	-4.5	16.7
BARRIC A	1230.00	WORTON PT	FEB 24	1054-1128	0102-0136	114.6	118.2	-3.7	18.0
BARRIC A	1230.00	KINNAIRD	FEB 24	1025-1133	0057-0205	117.7	114.5	3.2	13.0
BARRIC A	1230.00	KINNAIRD	FEB 24	1026-1134	0056-0205	118.4	115.2	3.2	16.3
BARRIC A	1230.00	KINNAIRD	FEB 24	1027-1135	0055-0203	118.1	115.3	2.8	16.7
BARRIC A	1230.00	KINNAIRD	FEB 24	1018-1128	0102-0212	117.9	115.5	2.4	18.0
BARRIC A	1230.00	CURTIN	FEB 24	1025-1308	0038-0205	114.9	115.2	-.3	13.0
BARRIC A	1230.00	CURTIN	FEB 24	1026-1309	0039-0205	113.2	115.9	-2.7	16.3
BARRIC A	1230.00	CURTIN	FEB 24	1027-1135	0055-0203	118.9	116.0	2.9	16.7
BARRIC A	1230.00	CURTIN	FEB 24	1018-1408	0032-0212	110.5	116.2	-5.7	18.0
BARRIC A	1230.00	TOLCHESTER	FEB 24	1025-1308	0038-0205	109.6	114.4	-4.8	13.0
BARRIC A	1230.00	TOLCHESTER	FEB 24	1026-1134	0056-0205	111.3	115.1	-3.8	16.3
BARRIC A	1230.00	TOLCHESTER	FEB 24	1027-1135	0055-0203	112.9	115.2	-2.3	16.7
BARRIC A	1230.00	TOLCHESTER	FEB 24	1018-1128	0102-0212	111.3	115.4	-4.1	18.0
BARRIC B	1230.00	HEMPHILL	FEB 24	1318-1407	0048-0137	113.9	112.5	1.4	13.6
BARRIC B	1230.00	GROVE PT	FEB 24	1100-1447	0130-0217	114.8	111.2	3.6	13.6
BARRIC B	1230.00	JENNINGS	FEB 24	1258-1447	0028-0217	110.2	117.9	-7.7	13.6
BARRIC B	1230.00	CURTIN	FEB 24	1100-1359	0038-0130	111.1	114.0	-2.9	13.6
BARRIC B	1230.00	TOLCHESTER	FEB 24	1100-1100	0130-0130	111.7	112.6	-.9	13.6
BARRIC C	1230.00	HEMPHILL	FEB 24	1406-1420	0136-0150	118.5	113.1	5.4	15.7
BARRIC C	1230.00	HEMPHILL	FEB 24	1344-1344	0114-0114	109.0	113.8	-4.8	19.6

RANGE	RAOB TIME	STATION	DATE	FIRING TIME	TIME DIFF	MIC	NAPS	DIFF	CHARGE
BARRIC C	1230.00	GROVE PT	FEB 24	1406-1420	0136-0150	114.4	111.4	3.1	15.7
BARRIC C	1230.00	GROVE PT	FEB 24	1344-1344	0114-0114	110.6	112.1	-1.5	19.6
BARRIC C	1230.00	JENNINGS	FEB 24	1406-1435	0136-0205	108.8	118.3	-9.5	15.7
BARRIC C	1230.00	KINNAIRD	FEB 24	1344-1344	0114-0114	121.4	114.7	6.7	19.6
BARRIC C	1230.00	CURTIN	FEB 24	1406-1426	0136-0156	110.2	114.3	-4.1	15.7
BARRIC C	1230.00	TOLCHESTER	FEB 24	1413-1413	0143-0143	107.0	112.7	-5.7	15.7
BALLISTIC	745.00	GROVE PT	FEB 25	0815-0815	0030-0030	116.2	108.6	7.6	5.0
BALLISTIC	745.00	JENNINGS	FEB 25	0815-0815	0030-0030	109.6	107.0	2.6	5.0
BALLISTIC	745.00	BETTERTON	FEB 25	0815-0815	0030-0030	121.2	107.3	13.9	5.0
FUZE	1300.00	HEMPHILL	FEB 25	1354-1423	0054-0123	102.7	121.4	-18.7	4.0
FUZE	1300.00	JENNINGS	FEB 25	1536-1631	0236-0331	94.3	109.2	-14.9	1.0
FUZE	1300.00	JENNINGS	FEB 25	1021-1434	0102-0238	96.9	113.8	-16.8	4.0
FUZE	1300.00	BETTERTON	FEB 25	1043-1135	0125-0217	111.8	114.5	-2.7	4.0
FUZE	1300.00	KINNAIRD	FEB 25	1043-1135	0126-0217	111.3	100.3	11.0	4.0
FUZE	1300.00	CURTIN	FEB 25	1523-1652	0223-0352	97.1	100.2	-3.1	1.0
FUZE	1300.00	CURTIN	FEB 25	1114-1518	0051-0218	99.8	104.6	-4.8	4.0
FUZE	1300.00	TOLCHESTER	FEB 25	1055-1055	0205-0205	105.5	84.1	21.4	4.0
BALLISTIC	800.00	HERRING	FEB 28	0814-0814	0014-0014	117.4	102.9	14.5	5.0
BALLISTIC	800.00	ENGSTROM	FEB 28	0814-0814	0014-0014	100.3	99.5	.8	5.0
BALLISTIC	800.00	ENGSTROM	MAR 01	0926-0926	0126-0126	103.8	102.0	1.8	5.0
BARRIC A	1100.00	ENGSTROM	MAR 01	0938-1118	0010-0122	109.7	110.0	-.4	13.0
BARRIC A	1100.00	ENGSTROM	MAR 01	0940-1118	0009-0120	111.2	110.8	.4	16.3
BARRIC A	1100.00	ENGSTROM	MAR 01	0941-1119	0008-0119	112.8	110.8	2.0	16.7
BARRIC A	1100.00	ENGSTROM	MAR 01	1045-1113	0013-0015	108.5	111.1	-2.6	18.0
BARRIC A	1315.00	ENGSTROM	MAR 01	1303-1337	0012-0022	103.9	99.7	4.3	13.0
BARRIC A	1315.00	ENGSTROM	MAR 01	1304-1338	0011-0023	107.3	100.4	6.9	16.3
BARRIC A	1315.00	ENGSTROM	MAR 01	1305-1339	0010-0024	109.9	100.5	9.4	16.7
BARRIC A	1315.00	ENGSTROM	MAR 01	1258-1436	0016-0121	108.6	100.7	7.9	18.0
BALLISTIC	745.00	GROVE PT	MAR 07	0816-0816	0031-0031	121.9	123.9	-2.0	5.0
BALLISTIC	745.00	HARRIS	MAR 07	0814-0814	0029-0029	102.8	100.3	2.5	5.0
BALLISTIC	745.00	HUTCHINSON	MAR 07	0815-0815	0030-0030	104.1	99.8	4.3	5.0
FUZE	1100.00	HEMPHILL	MAR 07	1017-1409	0014-0309	101.6	132.7	-31.1	4.0
FUZE	1100.00	HEMPHILL	MAR 07	1020-1406	0011-0306	105.8	134.1	-28.3	6.0
FUZE	1100.00	HEMPHILL	MAR 07	1027-1411	0009-0311	106.0	135.1	-29.1	8.0
FUZE	1100.00	HEMPHILL	MAR 07	1031-1443	0003-0343	105.4	135.8	-30.5	10.0
FUZE	1100.00	HEMPHILL	MAR 07	1035-1437	0002-0337	105.3	136.7	-31.4	13.0
FUZE	1100.00	GROVE PT	MAR 07	1344-1433	0244-0333	107.6	134.5	-26.8	10.0
FUZE	1100.00	GROVE PT	MAR 07	1347-1347	0247-0247	115.6	135.3	-19.7	13.0

RANGE	RAOB TIME	STATION	DATE	FIRING TIME	TIME DIFF	MIC	NAPS	DIFF	CHARGE
FUZE	1100.00	HARRIS	MAR 07	1017-1426	0014-0326	96.7	97.1	-.3	4.0
FUZE	1100.00	HARRIS	MAR 07	1127-1406	0027-0306	97.9	98.3	-.5	6.0
FUZE	1100.00	HARRIS	MAR 07	1027-1429	0033-0329	98.7	99.3	-.6	8.0
FUZE	1100.00	HARRIS	MAR 07	1031-1443	0003-0343	105.7	100.0	5.7	10.0
FUZE	1100.00	HARRIS	MAR 07	1035-1437	0002-0337	102.4	100.8	1.6	13.0
FUZE	1100.00	BETTERTON	MAR 07	1347-1347	0247-0247	116.3	116.1	.2	13.0
FUZE	1100.00	HUTCHINSON	MAR 07	1341-1341	0241-0241	96.6	95.0	1.6	8.0
FUZE	1100.00	HUTCHINSON	MAR 07	1055-1415	0003-0315	100.0	95.7	4.3	10.0
FUZE	1100.00	HUTCHINSON	MAR 07	1058-1058	0002-0002	107.3	96.6	10.7	13.0
BALLISTIC	745.00	HEMPHILL	MAR 08	0813-0813	0028-0028	118.6	120.8	-2.2	5.0
BALLISTIC	745.00	GROVE PT	MAR 08	0813-0813	0028-0028	118.8	112.9	5.9	5.0
BALLISTIC	745.00	BETTERTON	MAR 08	0813-0813	0028-0028	119.0	111.5	7.5	5.0
BALLISTIC	745.00	HUTCHINSON	MAR 08	0812-0812	0027-0027	110.8	100.0	10.8	5.0
BALLISTIC	745.00	TOLCHESTER	MAR 08	0814-0814	0029-0029	106.7	89.1	17.6	5.0
BARRIC A	1245.00	HEMPHILL	MAR 08	1301-1424	0016-0139	120.1	124.3	-4.2	13.0
BARRIC A	1245.00	HEMPHILL	MAR 08	1302-1426	0017-0141	119.4	125.1	-5.7	16.3
BARRIC A	1245.00	HEMPHILL	MAR 08	1303-1427	0018-0142	120.0	125.2	-5.1	16.7
BARRIC A	1245.00	HEMPHILL	MAR 08	1420-1420	0135-0135	119.4	125.5	-6.1	18.0
BARRIC A	1245.00	GROVE PT	MAR 08	1301-1424	0016-0139	117.4	112.5	4.9	13.0
BARRIC A	1245.00	GROVE PT	MAR 08	1302-1426	0017-0141	117.4	113.2	4.2	16.3
BARRIC A	1245.00	GROVE PT	MAR 08	1303-1451	0018-0206	118.7	113.3	5.4	16.7
BARRIC A	1245.00	GROVE PT	MAR 08	1420-1524	0135-0239	117.3	113.5	3.7	18.0
BARRIC A	1245.00	BETTERTON	MAR 08	1301-1424	0016-0139	123.3	115.3	8.0	13.0
BARRIC A	1245.00	BETTERTON	MAR 08	1302-1426	0017-0141	122.9	115.9	6.9	16.3
BARRIC A	1245.00	BETTERTON	MAR 08	1303-1427	0018-0142	123.9	116.0	7.9	16.7
BARRIC A	1245.00	BETTERTON	MAR 08	1420-1524	0135-0239	120.4	116.2	4.1	18.0
BARRIC A	1245.00	WORTON PT	MAR 08	1301-1350	0016-0105	116.6	97.3	19.3	13.0
BARRIC A	1245.00	WORTON PT	MAR 08	1302-1351	0017-0106	115.4	98.0	17.4	16.3
BARRIC A	1245.00	WORTON PT	MAR 08	1303-1352	0018-0107	115.1	98.1	17.0	16.7
BARRIC A	1245.00	HUTCHINSON	MAR 08	1301-1424	0016-0139	110.4	109.5	.9	13.0
BARRIC A	1245.00	HUTCHINSON	MAR 08	1312-1426	0027-0141	110.5	110.2	.2	16.3
BARRIC A	1245.00	HUTCHINSON	MAR 08	1313-1451	0028-0206	111.0	110.3	.7	16.7
BARRIC A	1245.00	HUTCHINSON	MAR 08	1420-1456	0135-0211	104.4	110.6	-6.2	18.0
BARRIC A	1245.00	TOLCHESTER	MAR 08	1301-1310	0016-0025	110.3	89.5	20.7	13.0
BARRIC A	1245.00	TOLCHESTER	MAR 08	1302-1312	0017-0027	110.6	90.2	20.3	16.3
BARRIC A	1245.00	TOLCHESTER	MAR 08	1303-1313	0018-0028	110.5	90.3	20.2	16.7
BALLISTIC	745.00	HEMPHILL	MAR 11	0813-0813	0028-0028	116.3	98.4	17.9	5.0
BALLISTIC	745.00	HARRIS	MAR 11	0813-0813	0028-0028	116.9	103.2	13.7	5.0
BALLISTIC	745.00	BETTERTON	MAR 11	0814-0814	0029-0029	120.3	121.7	-1.4	5.0
BALLISTIC	745.00	HUTCHINSON	MAR 11	0813-0813	0028-0028	112.9	98.1	14.8	5.0
BALLISTIC	800.00	GROVE PT	MAR 14	0814-0814	0014-0014	118.5	117.0	1.5	5.0
BALLISTIC	800.00	JENNINGS	MAR 14	0813-0813	0013-0013	110.6	111.0	-.4	5.0

RANGE	RAOB TIME	STATION	DATE	FIRING TIME	TIME DIFF	MIC	NAPS	DIFF	CHARGE
BALLISTIC	800.00	BETTERTON	MAR 14	0813-0813	0013-0013	115.9	104.9	11.0	5.0
BALLISTIC	800.00	WILLIAMS	MAR 14	0813-0813	0013-0013	98.8	88.8	10.0	5.0
BALLISTIC	800.00	GROVE PT	MAR 16	0815-0815	0015-0015	115.8	106.1	9.7	5.0
BALLISTIC	730.00	GROVE PT	MAR 17	0816-0816	0046-0046	119.5	99.4	20.1	5.0
BALLISTIC	730.00	JENNINGS	MAR 17	0816-0816	0046-0046	108.5	97.1	11.4	5.0
FUZE	1100.00	ENGSTROM	MAR 21	1444-1444	0344-0344	110.3	94.1	16.2	13.0
FUZE	1100.00	TOLCHESTER	MAR 21	1004-1004	0056-0056	105.0	84.1	20.9	4.0
FUZE	1100.00	TOLCHESTER	MAR 21	1119-1119	0019-0019	106.2	86.3	19.9	8.0
FUZE	1100.00	TOLCHESTER	MAR 21	1515-1515	0415-0415	105.3	87.9	17.4	13.0
BALLISTIC	745.00	HEMPHILL	MAR 23	0816-0816	0031-0031	124.1	101.3	22.8	5.0
BALLISTIC	745.00	GROVE PT	MAR 23	0816-0816	0031-0031	117.3	119.8	-2.5	5.0
BALLISTIC	745.00	BETTERTON	MAR 23	0816-0816	0031-0031	122.0	119.7	2.3	5.0
BALLISTIC	745.00	KINNAIRD	MAR 23	0815-0815	0030-0030	113.6	117.3	-3.7	5.0
BALLISTIC	745.00	HERRING	MAR 23	0815-0815	0030-0030	118.0	116.1	1.9	5.0
FUZE	1100.00	HEMPHILL	MAR 23	0922-1529	0001-0429	110.3	114.9	-4.6	1.0
FUZE	1100.00	GROVE PT	MAR 23	0922-1004	0056-0138	110.1	117.7	-7.6	1.0
FUZE	1100.00	BETTERTON	MAR 23	0922-1529	0004-0429	115.3	117.9	-2.6	1.0
FUZE	1100.00	WORTON PT	MAR 23	1017-1017	0043-0043	107.6	85.8	21.8	1.0
FUZE	1100.00	KINNAIRD	MAR 23	0926-1133	0004-0134	108.7	88.0	20.7	1.0
FUZE	1100.00	HERRING	MAR 23	0922-1529	0001-0429	105.8	87.6	18.2	1.0
FUZE	1100.00	ENGSTROM	MAR 23	0922-1529	0007-0429	103.2	97.0	6.2	1.0
FUZE	1100.00	TOLCHESTER	MAR 23	0926-1527	0043-0427	106.5	79.7	26.8	1.0
BALLISTIC	745.00	HEMPHILL	MAR 24	0813-0813	0028-0028	125.9	108.5	17.4	5.0
BALLISTIC	745.00	KINNAIRD	MAR 24	0813-0813	0028-0028	113.0	122.0	-9.0	5.0
BALLISTIC	745.00	HERRING	MAR 24	0813-0813	0028-0028	111.9	121.1	-9.2	5.0
BALLISTIC	745.00	GROVE PT	MAR 25	0815-0815	0030-0030	117.8	99.4	18.4	5.0
BALLISTIC	745.00	BETTERTON	MAR 25	0815-0815	0030-0030	120.5	98.5	22.0	5.0
BALLISTIC	745.00	WORTON PT	MAR 25	0815-0815	0030-0030	113.6	91.8	21.8	5.0
BALLISTIC	745.00	KINNAIRD	MAR 25	0814-0948	0029-0203	111.8	93.7	18.0	5.0
BALLISTIC	745.00	HERRING	MAR 25	0814-0948	0029-0203	117.5	93.3	24.2	5.0
BALLISTIC	745.00	ENGSTROM	MAR 25	0814-0814	0029-0029	104.5	88.6	15.9	5.0
BALLISTIC	800.00	BETTERTON	MAR 29	0814-0814	0014-0014	119.8	98.5	21.3	5.0
BALLISTIC	800.00	HERRING	MAR 29	0813-0813	0013-0013	97.0	93.3	3.7	5.0
BALLISTIC	800.00	ENGSTROM	MAR 29	0813-0813	0013-0013	101.4	88.6	12.8	5.0
BARRIC A	1144.45	GROVE PT	MAR 29	0941-0949	0156-0204	115.5	110.2	5.3	13.0
BARRIC A	1144.45	GROVE PT	MAR 29	0942-0950	0155-0203	116.7	111.0	5.7	16.3
BARRIC A	1144.45	GROVE PT	MAR 29	1018-1018	0127-0127	115.8	111.3	4.5	18.0

RANGE	RAOB TIME	STATION	DATE	FIRING TIME	TIME DIFF	MIC	NAPS	DIFF	CHARGE
BARRIC A	1144.45	BETTERTON	MAR 29	0860-1304	0017-0245	120.6	120.2	.4	13.0
BARRIC A	1144.45	BETTERTON	MAR 29	0902-1129	0016-0243	122.1	120.9	1.2	16.3
BARRIC A	1144.45	BETTERTON	MAR 29	0904-1130	0015-0241	121.4	121.0	.4	16.7
BARRIC A	1144.45	BETTERTON	MAR 29	1018-1401	0023-0256	119.6	121.2	-1.6	18.0
BARRIC A	1144.45	WORTON PT	MAR 29	1024-1024	0120-0120	116.7	96.4	20.3	16.3
BARRIC A	1144.45	WORTON PT	MAR 29	0915-1057	0047-0230	118.1	96.5	21.6	16.7
BARRIC A	1144.45	HERRING	MAR 29	0860-1304	0017-0245	116.8	98.3	18.5	13.0
BARRIC A	1144.45	HERRING	MAR 29	0902-1305	0016-0243	111.0	99.0	12.0	16.3
BARRIC A	1144.45	HERRING	MAR 29	0904-1305	0015-0241	113.9	99.1	14.8	16.7
BARRIC A	1144.45	HERRING	MAR 29	1018-1401	0023-0216	110.3	99.3	11.0	18.0
BARRIC A	1144.45	ENGSTROM	MAR 29	0860-1304	0050-0245	104.2	95.3	8.8	13.0
BARRIC A	1144.45	ENGSTROM	MAR 29	0902-1056	0049-0243	104.6	96.1	8.5	16.3
BARRIC A	1144.45	ENGSTROM	MAR 29	0904-1057	0047-0241	104.7	96.1	8.6	16.7
BARRIC A	1144.45	ENGSTROM	MAR 29	1051-1356	0054-0211	106.2	96.4	9.8	18.0
BALLISTIC	800.00	HERRING	MAR 30	0815-0815	0015-0015	100.6	106.8	-6.2	5.0
BALLISTIC	800.00	ENGSTROM	MAR 30	0815-0815	0015-0015	107.0	91.1	15.9	5.0

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